Africa Workshop on Food Processing and Minor Forest Product Global Value Chains

ACGD & WIEGO, Kampala, December 10-12, 2002

Network for the Valorization of Plant Materials in Africa (VPMA): Overview and Lessons Learned

By F. Gasengayire, IDRC, Nairobi.

Introduction

- The International Development Research Centre (IDRC) has promoted and funded research and development on utilization of plant materials in Africa for several years in order to generate income and provide jobs for local underpriviledged communities.

Introduction (Cont.)

- **More than twenty projects have been implemented in thirteen countries throughout Africa: Benin, Burkina Faso, Cameroon, Ghana, Guinea, Malawi, Morocco, Nigeria, Rwanda, Senegal, Tanzania, Togo, Uganda, and Zimbabwe. The projects delt /are dealing with a number of natural products, including essential oils such as the essential oils from *Thyme, Verbena, Artemisia herba alba, Rosemary, Lemongrass, Citronella, Mints, Ocimums, Eucalyptus, Ammi visnaga, Pelargonium graveolens, Tagetes minuta, Clausena, anisata, Lippia multiflora, Melaleuca quinquinerva,* etc., vegetable oils such as *shea nut butter, neem oil, rubber seed oil, argan oil,* seaweeds, specific coumpounds (such as *l-camphor, d-borneol, tabersonine, indigo, carraghenans),* wood adhesives, wood preservatives, starch adhesives and value-added products from cassava.**

Introduction (Cont.)

- The Network for the Valorization of Plant Materials in Africa (**VPMA**) was conceived as a South-South and South-North collaborative mechanism.
- It was set up in late 1994 to address a number of common problems and concerns encountered by researchers involved in R& D on natural products from plant origin.

Issues and problems addressed

- Technology development/adaptation for value-added processing of plant materials;
- Getting research results from laboratory scale to pilot plant scale;
- Lack of communication and exchange of experience between researchers;
- Lack of access to S &T information needed;

Issues and problems addressed (Cont.)

- Knowledge of/Access to local, regional and international markets of the products to be developed;
- Natural resources management;
- Quality and quality control of natural products from plant origin;
- Project management;
- Research-Industry partnership;

Issues and problems addressed (Cont.)

- Technology transfer by promoting the diffusion and commercial development of research results/existing techniques (promoting local partnerships and entrepreneurship, market analysis and market development, business plans, dissemination of research results by use of ICTs, etc.).

The Shared Goal

- **The general objective was to promote the utilization of plant materials in a sustainable, participatory and environmentally sound way, in order to create jobs and generate income for the benefit of local poor communities of the countries involved.**

Membership

Projects and principal investigators:

- Colorants anthocyaniques / Anthocyanic Dyes (Faso) I (88-1034) & II (90-1008)

Dr. Mouhoussine Nacro: Université de Ouagadougou (Ouagadougou, Burkina Faso)

Dr. A.C. Oehlschlager: Université Simon Fraser de Vancouver (Vancouver, Canada)

- Huiles végétales non alimentaires /Non Edible Vegetable Oils (Faso) I (89-0075) & II (91-1029)

Dr. Rigobert Yaméogo: Institut de recherches en sciences appliquées et technologiques (IRSAT) (Ouagadougou, Burkina Faso)

Dr. Suzanne Coulombe: Centre de recherches industrielles du Québec (CRIQ) (Québec,canada)

Membership (Cont.)

Projects and principal investigators:

- Transformation du beurre de karité /Processing of Shea Nut Butter (Faso) (02724)

Dr. Rigobert Yaméogo:IRSAT (Ouagadougou, Burkina Faso)

Dr. Joawad Fichtali: POS Pilot Plant Corp., Saskatoon (Canada)

- Essences végétales /Essential Oils (Rwanda) I (89-1039) & II (94-8504)

Dr. Ntezurubanza Léopold: IRST-CURPHAMETRA (Rwanda)

Prof. Guy Collin: Université du Québec à Chicoutimi (Chicoutimi, Canada)

- Plantes aromatiques/Aromatic Plants (Maroc) I (90-1001) & II (92-1011)

Prof. Bachir Benjilali: IAV Hassan II (Rabat, Maroc)

Dr. André Bélanger: CRDH-Agriculture et agroalimentaire Canada (St-Jean-sur-Richelieu,Canada)

Membership (Cont.)

Projects and principal investigators:

- Wood Adhesives (Tanzania) I (90-1019) & II (92-1452)

M. B. A. Mwingira: TIRDO (Dar es Salaam, Tanzania)

M. Jack Shields: Forintek Canada Corporation (Québec, Canada)

- Algues rouges/Red Seaweed (Sénégal) I (90-1024) & II (97-8155)

M. Abdourahmane Tamba: SOS Environnement (Dakar, Sénégal),

Dr. Thierry Chopin: Université du Nouveau-Brunswick (Nouveau Brunswick, Canada)

Dr. Glyn Sharp: Ministère des pêches et océans du Canada (Halifax, Nouvelle -Ecosse)

- Tabersonine (Cameroun) (90-1025)

Dr. Goghomu Tih: Université de Yaoundé (Yaoundé, Cameroun)

Dr. W. Ayer: Université d'Alberta (Edmonton, Canada)

Membership (Cont.)

Projects and principal investigators:

- Teintures traditionnelles/Traditional Dyeing (Guinée)I (91-1003)&II (55494)

Dr. Morlaye Bangoura: MESRES-Projet PERTEGUI (Conakry, Guinée)

M. Normand Jubinville: Centre des technologies textiles (St-Hyacinthe, Canada)

- Extraits aromatiques /Aromatic Extracts (Guinée) (91-1002)

Dr. Malo Nianga: LACONA (Conakry, Guinée),

Prof. Bachir Benjilali: IAV Hassan II (Rabat,Maroc)

Dr. Sylvain Savard: CRIQ (Québec, Canada)

- Rubber Seed Oil (Nigeria) (92-1003)

Dr. I.C. Ononogbu: University of Nigeria, (Nsukka, Nigeria)

Dr.Yaw J. Owusu-Ansah+: POS Pilot Plant Corporation (Saskatoon, Canada)

Membership (Cont.)

- **Projects and principal investigators:**
- **Starch Adhesives (Malawi) (92-1451)**

Dr. E. Fabiano: Chancellor College, University of Malawi (Zomba, Malawi)

M. Jack Shields: Forintek Canada Corporation (Québec, Canada)

- **Création de petites entreprises /Creation of Small Scale Enterprises (Togo-Bénin-Ghana) (92-1350)**

Dr. Koumaglo Kossi Honoré: Université du Bénin (Lomé, Togo),

Dr.Moudachirou Mansour: Université nationale du Bénin (Cotonu, Bénin),

Prof. Ivan Addae-Mensah: University of Ghana, Legon (Accra, Ghana)

Prof. François-Xavier Garneau: Université du Québec à Chicoutimi (Chicoutimi, Canada)

- **Flavours and Fragrances (Zimbabwe) (91-1022)**

Dr. Lameck Chagonda: University of Zimbabwe (Harare, Zimbabwe),

Dr. Jocelyn Paré: Environnement Canada (Ottawa, Canada)

Membership (Cont.)

Projects and principal investigators:

- **Value-Added Products from Cassava (Uganda) (94-8493)**

Dr. G.B. Mpango: Makerere University (Kampala, Uganda)

- **Biotransformations (Maroc) I (95-8604) & II (100280)**

Dr. Ismaili-Alaoui My Mustapha: IAV Hassan II (Rabat, Maroc)

Dr. André Morin: CRDA-Agriculture et agroalimentaire Canada (St-Hyacinthe, Canada)

Dr. Alain Houde: CRDA-Agriculture et agroalimentaire Canada (St-Hyacinthe, Canada)

- **Essential Oils (Malawi) (97-8535)**

Dr. Wellington Masamba: Chancellor College, University of Malawi (Zomba, Malawi)

Membership (Cont.)

Projects and principal investigators:

- **Valorisation de l'arganier/Valorization of Argan Tree (Maroc) (97-8602)**

Dr. Zoubida Charrouf: Université Mohamed IV (Rabat, Maroc)

Dr. Faiçal Benchekroun: IAV Hassan II (Rabat, Maroc)

- **Bioinsecticides (Afrique) (97-1351)**

Dr. Rigobert Yameogo:IRSAT (Ouagadougou, Burkina Faso)

Dr. André Bélanger:CRDH-Agriculture et agroalimentaire Canada (St-Jean-sur-Richelieu, Canada)

- **Indigenous Food Plants (Uganda) (98-8550)**

Dr. Bernard Kiremire: Makerere University (Kampala, Uganda)

Membership (Cont.)

CBOs, NGOs, Cooperatives:

- **Association pour le développement des plantes aromatiques et médicinales (ADEPAM)** (Association for the Development of Aromatic and Medicinal Plants), in Morocco;
- **Association pour la promotion des plantes à parfums, aromatiques et médicinales pour le développement (APPAM-DEV)** (Association for the Promotion of Aromatic and Medicinal Plants for Development), in Bénin;
- **Organisation Plantes aromatiques et huiles essentielles (PARHETO)** (Organisation Aromatic Plants and Essential Oils), in Togo;
- **Ghana Citronella Farmers Association**, in Ghana;
- **VAP AGRO-PRODUCTS Ltd.**, in Uganda;

Membership (Cont.)

CBOs, NGOs, Cooperatives:

- **Groupements d'intérêt économique de Pointe Sarène et de Dakar** (Economic Interest Groups from Pointe Sarène and Dakar), in Senegal;
- **Groupement féminin d'extraction de l'indigo de Bokariah** (Women Association from Bokariah for Extraction of Indigo) in Guinea; and
- **Coopératives de femmes de Tamanar et de Tidzi** (Women Cooperatives from Tamanar and Tidzi) in Morocco.

Main Results

- **Improved techniques for plant processing developed and tested;**
- **Pilot plant production of a number of natural products (essential oils, Argan oil, Shea butter, etc.);**
- **Development of knowledge on plant resources (botany, taxonomy, agronomy) and related natural products (composition and physico-chemical properties);**
- **Development of knowledge related to the quality and marketing of natural products, natural resources management, participatory rural approaches and project management through case studies and training;**
- **Transfer of research results to target communities and their dissemination;**
- **Facilitation of the formation of local communities associations/NGOs;**
- **Development of databases as research tools (on essential oils);**
- **Capacity built for investigation of natural products from plant origin;**

Main Results (Cont.)

- Income generated for local communities through processing and sale of natural products from plant origin (Morocco, Burkina Faso, Guinea);
- Market analyses and feasibility studies done (Burkina Faso, Senegal, Togo-Benin-Ghana, Tanzania, Morocco)
- Improvement on the social and economic standard of women involved in some projects (Morocco);
- Influence of policy and legislation in some countries (Burkina Faso, Senegal);
- Collaboration between institutions and researchers established and strengthened;
- Organisation of colloquiums on natural products (Chicoutimi, Canada 1993, St-Jean-sur-Richelieu, Canada, 1995; Ottawa, Canada, 1998, Sainte Foy, Canada, 2001) and workshops on marketing of natural products and resource management (Zomba, Malawi, 1996) and on strategies for transfer of research results to users (Lomé, Togo, and Accra, Ghana, 1999);
- Publication of the proceedings of the colloquiums and workshops;
- Websites: http:// www.iupac.org/links/vpma/index.html

Constraints and Gaps

- **Constraints, problems and gaps observed relate mainly to illiteracy, lack of enterpreneurial skills, lack of investment capacity and marketing skills, and lack of a conducive technical, economical and policy environment in most cases.**

Case Study1:Valorization of Argan Tree Morocco

- In Morocco, the aim of the Valorization of Argan Tree Project is to contribute to the preservation of biodiversity in the South-West of Morocco, through the development and the transfer of a package of technologies needed for sustainable utilisation of various products from argan tree by women groups of that region. The Argan tree (*Argania spinosa (L.) Skeels*) is an endemic tree in Morocco and the second important one in the country after the oak and before the thuja. It is very resistant to dryness and heat. It grows naturally in the semi-arid and arid zones of the South-West of Morocco, where it plays a vital role in maintaining ecological equilibrium and in preserving biodiversity. Hence, it highly contributes to prevent desertification of that region by protecting the soil against water and wind erosions.

Case Study1:Valorization of Argan Tree – Morocco (Cont.)

- **The argan oil is edible and is also used in traditional medicine. About three million people depend on the argan forest for subsistence. The project is working to increase the potential production of the argan tree by improving the traditional techniques for the extraction of argan oil, and by conducting required chemical and pharmacological studies and formulations of various argan oil derived products.**

Case Study 1:Valorization of Argan Tree – Morocco (Cont.)

Traditional production of argan oil

- **Collection of argan nuts/almonds**
- **Manually shelling of argan nuts using stones almonds, crushing of almonds, and pressing oil**
- **20 hours of hard work are required to extract/produce 1 litre of argan oil. The oil is packaged in recycled bottles and sold alongsideroad.**

Improved techonology by the project

- **Mechanisation of the processes (shelling, crushing and pressing) resulting in an increase of 50% of the yield of extraction, quality improvement of the oil, and substantial reduction of the time and labour.**

Argan oil: thanks to its high concentration in essential fatty acids (linoleic acid: 34%) and high percentage in unsaturated fatty acids (80%), argan oil reduces cholesterol levels and prevents artherosclerosis.

The project facilitated the creation of the Amal Cooperative of women in Tamanar to develop the production and commercialisation of argan oil

Case Study1:Valorization of Argan Tree – Morocco (Cont.)

- **Training** of women trainers of the Amal Cooperative on new techniques of marketing (selling methods to households, friends, dietary and pharmacy shops, etc.)
- **Quality certification /** biological label
  Assessment of the production processesses was done by the organisation Qualité France who granted a biological label to the Amal Cooperative products. Three products are marketed: **Arganati** (pure argan oil with a delicate taste), **Arganium**
  a natural beauty serum) and **Amlou beldi** (a delicious spread for breakfast)
  Thanks to the bio-certification, the Amal Cooperative was able to export its products to Europe and America. By the end of 2001 the Cooperative could sell for up to 100,000 Drh (about $US 10,000)
- **Dissemination** of research results/products through website and leaflets (English, French and German):
- European Community is currently considering to fund a large project based on the Amal Cooperative model to develop the production of argan oil and preserve the argan-based biodiversity

Case Study2: Non Edible Vegetable Oils - Burkina Faso

- Shea nuts and butter are an important source of income for rural women of Sahel. Traditionally, women and children harvest nuts during the wet season, process and store them. Later on, butter is also extracted by women during the dry season. In Burkina Faso, the Non Edible Vegetable Oils Project has developed a set of technologies that constitute an extraction unit of fat oils, made of dehuller, nuts crusher, roaster and an improved manual press that enable to relieve work hardship and to increase income of the women groups involved in the production of these vegetable oils, in the arid regions in the North of Burkina Faso, where the production of these oils is the only source of income during nine month of the dry season. The project has also adapted a soap mixer and has studied oils of several plants including: *Balanites, Shea, Neem, Sclerocarya, Ziziphus and Lannea*

Case Study2: Non Edible Vegetable Oils - Burkina Faso (Cont.)

- The fatty acids composition of extracted oils has been determined as well as some secondary products with specific activity. Formulations of antidermatosis soaps from neem oil and new formulations of peanuts flours have been done. The results of the project have been extensively disseminated through workshops and documentary movies on the national television and on TV5 (International Television Francophone Network). A collaboration with the Canadian International Development Agency has been developed thanks to the project, and has involved many local and regional partners. The project is now working on the transfer of this technology package to local small enterprises interested.
- A feasibility study (technical, financial, economic) was done with the view to promoting the creation of small scale enterprises for the production of shea butter. The study indicates that the venture is profitable, though there are still concerns relating to the market.

Case Study 2: Non Edible Vegetable Oils - Burkina Faso (Cont.)

- The Burkina Faso Government has identified the shea butter, as one of few renewable natural resources presenting a great potential for export. It bought 80 presses designed by the research project for use by women groups involved in this activity. Canadian International Development Agency has approved a consolidating project to support the development of "Shea butter filière" by improving its efficacy and increasing its contribution to the national economy.
- Research is still going on to set up purification standard methods in order to improve the quality of products. In this regard, researchers from the *Institut de recherche en sciences appliquées et technologiques (IRSAT),* with their Canadian partners, are searching new methods for processing shea butter to improve its quality. These methods should improve on the colour and the rancidness of the butter in order to enhance its acceptability on the national market as a substitute to imported oils used in food preparations, and on international market for pharmaceutical and cosmetic industry.

Case Study3: Traditional Dyeing - Guinea

- In Guinea, the traditional dyeing represents 35% of the handcraft production of Guinea and 80%of people involved in these activities are women.
- The traditional process consists of preparing a dyeing vat by soaking leaves of Indigo (*Indigofera tinctoria)* and *Morinda germinata* in water for about 2 weeks. Then a prepared clothe is dipped into the bath of indigo.
- The project has successfully introduced a new technique for the extraction of the natural indigo in a dry form within 30 hours, which can be used directly in the dyeing process. This improved technique consists of: anaerobic fermentation of indigo leaves in water, pressing to obtain indigo solution, settling and filtration of the solution. The filtrate is then precipitated by agitation and addition of lime. 1kg of leaves gives 35 gr of powder containing 10% of indigo. This new technique enables to reduce by 6 times the duration required in the traditional method. The project also proposed many modifications to the dyeing process adapted to the Guinean context using the indigo powder.

Case Study3: Traditional Dyeing - Guinea (Cont.)

- As a result of these innovations, the production costs were considerably reduced and the production capacity of women was doubled, and their physical efforts were relieved as well.
- Several interesting local initiatives built on the project experience to disseminate the new technology with the support of international organizations based in Guinea. A small training centre in the new technology for the extraction of the indigo was set up in Bokariah (Prefecture of Kindia) by the *Association Guinéenne des Femmes Chercheures* (Guinean Association of Female Researchers), where hundreds of women dyers have been trained.
- Women groups/associations from Bokariah and elsewhere have been producing and selling indigo (dry form) as well as dyed fabrics.
- Experience indicates that there is local and regional markets for indigo dyed clothing (Guinea, Senegal, Mali and South Africa) and the potential for their expansion is high.

Case Study 3:Traditional Dyeing - Guinea (Cont.)

- A small scale enterprise « Teinture-Promotion Labé » was created in 1994 with the support from The Christian Reformed World Relief Commitee (A USA based NGO) for the distribution and marketing of clothes dyed with indigo in North America (USA and Canada). Dyers bring dyed fabrics to this enterprise that are made as ready-made clothes by outfitters and exported.
- The Traditional Dyeing Project is currently working on improving the yield of the extraction technique, disseminating « good practices » to female dyers, analysing local market channels, developing guinean expertise in various textile techniques (design, dyeing and printing), strengthening management and administrative skills of women cooperatives, and promoting indigo-based small scales entreprises.